

## ABSTRACT OF THE INVENTION

In a system for implanting workpieces with an accurately parallel scanned ion beam, a fine-control collimator construct is used to reduce the deviation of the scanned ion beam from a specified axis of parallelism and thereby improve its collimation. The shape of the fine-control collimator matches the ribbon shape of the beam and correction of parallelism in two orthogonal directions is possible. Measurement of the non-parallelism is accomplished by sampling the scanned beam in two planes and comparing timing information; and such measurement is calibrated to the orientation of the workpiece in the plane where ion implantation occurs. Measurement of non-uniformity in the doping profile is accomplished using the same means; and the scan waveform is adjusted to substantially remove any non-uniformity in the doping profile.